REMARKS/ARGUMENTS

Claims 1-2 and 5-12 are pending.

Claims 1, 5, and 6 have been amended.

Claims 3-4 have been cancelled.

Claims 7-10 have been withdrawn.

Claims 11-12 have been added.

Support for the amendments is found in the claims and specification, as originally filed. Specifically, claim 1 comprises the limitations of claims 3 and 4. The term "the silicon nitride sintered body is subjected to a grinding work" is supported on page 19, line 9 of the present specification and, e.g., Examples 1B-2B, 22B-76B. Claim 11 is supported on page 18, lines 24-25. Claim 12 is supported on page 8, lines 22-23 and Table 3, e.g., Samples 3-21.

No new matter is believed to have been added.

The claimed silicon nitride abrasion resistant member is formed of a silicon nitride sintered body containing 2% to 4% by mass of a rare earth element in terms of oxide as a sintering aid, 2% to 6% by mass of an Al component in terms of oxide, 2% to 7% by mass of silicon carbide, 10 to 3000 ppm of Fe, and 10 to 1000 ppm of Ca, wherein said silicon nitride sintered body has a porosity of 1% or less, a three-point bending strength of 800 to 1000 MPa, and a fracture toughness of 5.7 to 6.5 $MPa \cdot m^{1/2}$, and the silicon nitride sintered body is subjected to a grinding work. *See*, claim 1.

Adding a raw material powder mixture, prepared by adding a predetermined amount of a rare earth element, aluminum component such as Al_2O_3 or AlN, silicon carbide, and compound of Ti, Hf, Zr to an inexpensive silicon nitride raw powder, has greatly improved sintering characteristics (see the present specification, pages 2-4). The resulting silicon nitride abrasion resistant member has a high density and a high mechanical strength, equal to

or higher than those of conventional silicon nitride sintered bodies, as well as a high abrasion resistance and, in particular, a *long rolling life* and *excellent workability*, and is suitable for a rolling bearing member (see the present specification, pages 2-4).

In particular, as described in the specification on page 4, lines 4-10, since particular impurity elements, i.e., iron (Fe) and calcium (Ca), are controlled to be within a particular range, the formation of *cohesive portions* (aggregated portions) in a sintered silicon nitride structure is effectively *prevented or reduced.* This reduces fragile portions serving as the origin (a starting portion) of a fracture and provides an abrasion resistant member having excellent life characteristics. (see page 4 and the Examples).

Claims 1-2 and 5-6 are rejected under 35 U.S.C. 102(e) over Komatsu et al., US 7,056,850, and 102(a) over Komatsu et al., JP 2003034581 (equivalent to US 7,056,850).

US 7,056,850 is a national stage of PCT/JP02/07435 published in Japanese as WO03/010113. Therefore, the 102(e) date of the '850 patent is the filing date of the US application 10/484,717, i.e., January 26, 2004, which is later than the filing date (September 25, 2003) of the priority Japanese application 2003-334122 in the present application. Thus, the '850 patent is not a prior art reference.

However, because WO03/010113 was published on February 6, 2003, Applicants have addressed the rejections below (references are provided with respect to US 7,056,850 as an English equivalent).

The rejections are traversed because Komatsu et al. do not describe or suggest that (a) Fe and Ca are contained in the silicon nitride abrasion resistant member in the predetermined amounts, and (b) that the sintered body is ground.

Komatsu et al. disclose a wear resistant member comprising a silicon nitride sintered body containing 2-10% of a rare earth element, 2-7% of $MgAl_2O_4$ spinet, 1-10% of SiC, 5% or less of Ti, Zr, Hf, W, Mo, Ta, Nb, and Cr, wherein a porosity of a silicon nitride sintered

body is 1vol.% or less, a three-point bending strength is 900MPa or more, and a fracture toughness is 6.3 MPa•m$^{1/2}$ or more (see col. 2-3; claim 1).

However, Komatsu et al. do not disclose a silicon nitride sintered body comprising 10 to 3000 ppm of Fe, and 10 to 1000 ppm of Ca, and that the sintered body is subjected to a ground work. Komatsu et al. do not describe using AlN or Al_2O_3 (claim 12).

Thus, Komatsu et al. do not anticipate the claimed member.

Komatsu et al. do not make the claimed member obvious. Specifically, one would not have been motivated to modify the Komatsu et al. member to arrive at the claimed member because Komatsu et al. do not concern preventing or reducing the formation of cohesive portions in a sintered silicon nitride structure which can be achieved by controlling particular impurity elements, i.e., (Fe) and (Ca), within a particular range.

Also, because the compositions of the wear resistant members of Komatsu et al. are different from those of the claimed members, the Komatsu et al. wear resistant member cannot exhibit the effects of the present invention. Namely, the effect of reducing the formation of cohesive portions in a sintered silicon nitride structure can not be exhibited in the members of Komatsu et al. The fragile portions serving as the origin of a fracture are inevitably occurred in the members of Komatsu et al. Thus, the claimed member provides advantageous properties compared to that of Komatsu et al. (see also the Examples of the present specification).

Thus, Komatsu et al. do not anticipate nor make the clamed member obvious. Applicants request that the rejection be withdrawn.

Claims 1, 3, and 4are rejected under 35 U.S.C. 103(a) over Komatsu et al., US 7,056,850, (Komatsu I) or JP 2003034581, (Komatsu II) and further in view of Komatsu, US 5,439,856 (Komatsu III). The rejection is traversed because

(a) one would not have been motivated to modify a wear resistant member of Komatsu I and II with the sintered body of Komatsu III with a reasonable expectation of success because the Komatsu III sintered body has a different composition and is prepared for a different purpose by a different method,

(b) the claimed silicon resistance member has advantageous characteristics to that of conventional sintered bodies, and

(c) the cited references do not describe that the sintered body is ground.

Komatsu I and II discloses a wear resistant member comprising a silicon nitride sintered body containing 2-10% of a rare earth element, 2-7% of $MgAl_2O_4$ spinet, 1-10% of SiC, 5% or less of Ti, Zr, Hf, W, Mo, Ta, Nb, and Cr, wherein a porosity of a silicon nitride sintered body is 1vol.% or less, a three-point bending strength is 900MPa or more, and a fracture toughness is 6.3 $MPa\bullet m^{1/2}$ or more (see col. 2-3; claim 1).

However, Komatsu I and II do not disclose a silicon nitride sintered body comprising 10 to 3000 ppm of Fe, and 10 to 1000 ppm of Ca.

The Komatsu I and II silicon nitride sintered body has a good wear resistance, good rolling life, and high density and is suitable as a rolling bearing member (col. 1-2). To achieve these characteristics, the sintering is conducted under a low temperature, i.e., below 1,600°C which is lower that the sintering temperature in conventional methods (1,700-1,900 °C) (col. 1-2).

Komatsu III describes a high thermal conductive silicon nitride sintered body containing: 2.0-7.5% of rare earth element; at most 0.3wt.% of Li, Na, K, Fe, Ca, Mg, St; if necessary, at most 2.0wt% of alumina. Thus, the Al compound is contained at an amount of 2wt% or less (see col. 5, last paragraph) (compared to Komatsu I and II: 2-7 mass% of $MgAl_2O_4$). The Komatsu III sintered body does not comprise SiC (compared to that of Komatsu I and II).

Further, Komatsu III describes that the high thermal conductivity and heat-radiating property of a sintered body is required in semiconductors (col. 1, lines 12-18, col. 2, lines 4-13). To achieve the high thermal conductivity, the sintering is conducted at a high temperature, i.e., 1800-2000°C (col. 4, lines 26-28). If the sintering temperature is lower than 1800 °C, the sintered body fails to achieve a sufficiently high density, porosity, mechanical strength and high thermal conductivity (col. 7, lines 11-29).

Thus, Komatsu III describes a specific composition and manufacturing conditions for achieving the high thermal conductivity and heat-radiating property of a sintered body used in semiconductors or as radiator plates.

The goal of Komatsu I and II is to obtain a wear resistant member having a good wear resistance, good rolling life, and high density and is suitable as a rolling bearing member. The Komatsu I and II wear resistant member has a different composition from that of Komatsu III (e.g., the content of Al, SiC), is produced by a different method (e.g., at a sintering temperature lower than 1,600°C verses 1800-2000°C of Komatsu III which also requires a tightly controlled cooling, see col. 7, lines 12-41), and is used for a different purpose (e.g., good wear resistance, good workability and good rolling life compared to the high thermal conductivity of Komatsu III).

One would not have been motivated to modify the Komatsu I and II wear resistant member by keeping the total amount of Fe and Ca at most 0.3 wt.% as in Komatsu III because the Komatsu III sintered body has a different composition, is prepared for a different purpose by a different method (e.g., at the mutually exclusive conditions and a content of the components).

Also, one would not have reasonably expected that the Komatsu I and II wear resistant member modified by according to Komatsu III would have had the desired wear resistance, good rolling life, and high density so as to be suitable as a rolling bearing member,

because these characteristics are achieved by a specific composition and manufacturing conditions of Komatsu I and II which are different from that of Komatsu III (i.e., outside the range of Komatsu I and II).

Also, the claimed member possesses advantageous characteristics compared to that of a conventional sintered body (e.g., Komatsu I and II and Komatsu III). Accordingly, since the amount of sintering agents and the amount of both Fe and Ca are strictly controlled, the claimed silicon nitride sintered body has an excellent three-point bending strength and fracture toughness each having an improved value range. Further, when both Fe and Ca are strictly controlled, *workability* of the sintered body is effectively improved, so that the resultant silicon nitride sintered body is suitable to be subjected to a grinding work without causing any cracks which would be defectives lowering the production yield of the abrasion resistant member.

When the amount of Fe and Ca impurities is increased, the characteristics such as bending strength and toughness of the resultant sintered body deteriorate. Therefore, both the upper and lower limits of the three-point bending strength and the fracture toughness of the claimed sintered body are clearly specified in the claims. That is, the present invention is the first case where a sintered body having excellent characteristics suitable for constituting the abrasion resistant member *while having an improved workability* (see the Examples and Tables).

Thus, Komatsu I, Komatsu II, and Komatsu III do not make the claimed silicon nitride abrasion resistant member obvious. Applicants request that the rejection be withdrawn.

Claims 1-2 and 5-6 are rejected under 35 U.S.C. 102(b or 103(a) over JP 404260669.

The rejection is traversed because JP '669 (a) does not describe or suggest that Fe and

Ca are contained in the silicon nitride abrasion resistant member in the predetermined amounts, and subjecting the sintered body to a ground work, and (b) the JP ‘669 does not necessarily have the claimed properties.

JP ‘669 describes a sintered body comprising 3% of yttria, 3% of Al spinel, 5% of SiC and a density of 99.3% (Example 2).

JP ‘669 does not describe the claimed porosity, 3-point bending strength, fracture toughness, rolling life, and rolling fatigue life. JP ‘669 does not describe that the claimed member is a bearing rolling ball (claim 11), that the sintered body is subjected to a ground work, and the Al component being Al_2O_3 or AlN (claim 12).

The Examiner is of the opinion that the claimed properties are inherent to the composition of JP ‘669. Applicants respectfully disagree.

The legal requirement for inherency is that “each and every time” the sintered body of the JP ‘669 is manufactured, it <u>must</u> have the claimed properties.

The Examples of the present application demonstrate that the claimed property of the silicon nitride abrasive resistant member depend on, e.g., the content of other compounds and manufacturing conditions. For example, the members of Examples 6 and 7 have the same content of yttria, Al_2O_3, and SiC but the properties of the members are different because they are produced by a different method (also compare Examples 13-21).

Thus, the JP ‘669 sintered body does not <u>necessarily</u> have the claimed properties.

Also, it would not have been obvious to modify JP ‘669 and select the claimed properties because JP ‘669 does not concern producing a silicon nitride abrasion resistant member having a high density and a high mechanical strength, equal to or higher than those of conventional silicon nitride sintered bodies, as well as high abrasion resistance and, in

particular, a *long rolling life* and *excellent workability*, and is suitable for a rolling bearing member (see the present specification, pages 2-4).

Thus, JP '669 does not anticipate or make the claimed member obvious. Applicants request that the rejection be withdrawn.

Claims 1-2 and 5-6 are rejected on the ground of nonstatutory obviousness-type double patenting over claims 1-4 of US Patent 7,056,850.

Applicants have introduced the limitations of claims 3-4, which have not been rejected on the ground of nonstatutory obviousness-type double patenting, into claim 1.

In addition, the claimed silicon nitride abrasion resistant member of claim 1 is formed of a silicon nitride sintered body containing 2% to 4% by mass of a rare earth element in terms of oxide thereof as a sintering aid, 2% to 6% by mass of an Al component in terms of oxide thereof, 2% to 7% by mass of silicon carbide, 10 to 3000 ppm of Fe, and 10 to 1000 ppm of Ca, wherein said silicon nitride sintered body has a porosity of 1% or less, a three-point bending strength of 800 to 1000 MPa, and a fracture toughness of 5.7 to 6.5 MPa•m$^{1/2}$, and the silicon nitride sintered body is subjected to a grinding work.

Claim 1 of the '850 patent is directed to a wear resistant member comprising a silicon nitride sintered body containing 2-10% of a rare earth element, 2-7% of $MgAl_2O_4$ spinet, 1-10% of SiC, 5% or less of Ti, Zr, Hf, W, Mo, Ta, Nb, and Cr, wherein a porosity of a silicon nitride sintered body is 1vol.% or less, a three-point bending strength is 900MPa or more, and a fracture toughness is 6.3 MPa•m$^{1/2}$ or more, and a maximum width of an aggregated segregation existing in a grain boundary phase is 5 μm or less.

Claim 1 of the '850 patent does not limit the wear resistant member to comprise 10 to 3000 ppm of Fe, and 10 to 1000 ppm of Ca. Also, one would not have been motivated to modify the wear resistant member of the '850 patent to arrive at the claimed member because

the '850 patent does not concern preventing or reduceing the formation of cohesive portions (aggregated portions) in a sintered silicon nitride structure which can be done by controlling particular impurity elements of iron (Fe) and calcium (Ca) at particular amounts. The reduced fragile portions serving as the origin (a starting portion) of a fracture provide an abrasion resistant member having excellent life characteristics.

Thus, the claimed member is not obvious over the claims of the '850 patent. Applicants request that the rejection be withdrawn.

A Notice of Allowance for all pending claims is requested.

Respectfully submitted,

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